High Intensity Post Stroke

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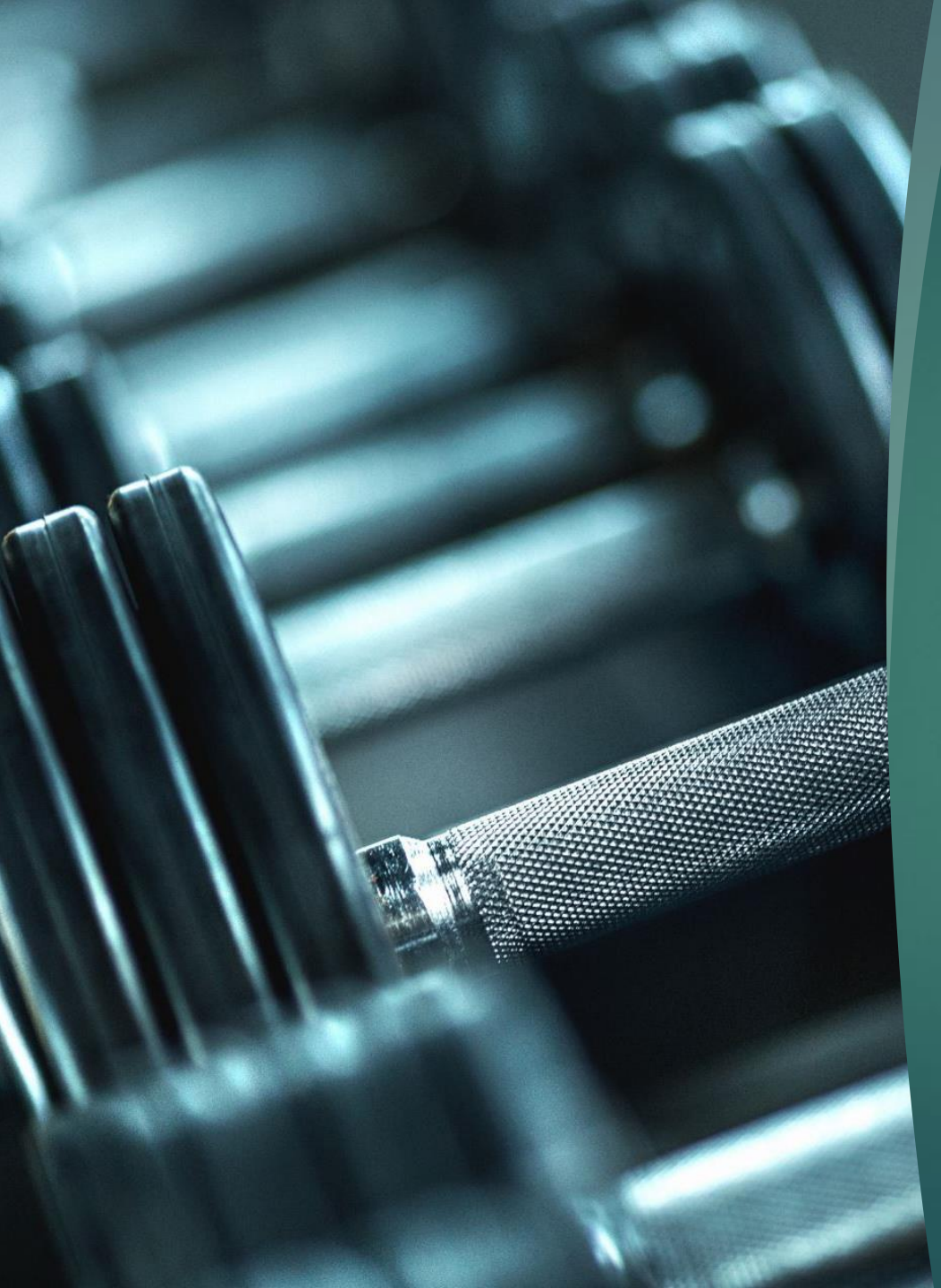
Introduction

- Stroke can result in multiple comorbidities including decreased mobility, cognition, quality of life, safety and balance along with increased fatigue, depression.
- Individuals post stroke have ~twice the energy cost for mobility and half the cardiorespiratory fitness compared to healthy individuals (12)
- Exercise Capacity has been shown to be 60% lower post stroke compared to age and sex matched peers (1)
- Following stroke 2/3 of individuals are unable to walk or require assistance 3 months after stroke (1)

Comorbidities after stroke related to function

- Very few stroke survivors demonstrate adequate walking speed and endurance to return to living independently and to actively participate in the community
- Lower quality of life
- Decreased walking capacity
- Decreased aerobic capacity
- Increased effort is required to complete regular activities throughout the day

3. Boyne, P et al. Factors influencing the efficacy of aerobic exercise for improving fitness and walking capacity after stroke: a meta-analysis with meta regression. Archives of Physical Medicine and Rehabilitation. 2017; 98:581-95.
4. Sandberg, K et al. Effects of twice-weekly intense aerobic exercise in early subacute stroke: a randomized control trial. Archives of Physical Medicine and Rehabilitation. 2016; 97: 1244-53
5. Gjellesvik TI et al. Effects of High-Intensity Interval training after stroke (the HIIT stroke study): A multi center randomized controlled trial. Archives of Physical Medicine and Rehabilitation. 2020; 101:939-47.
6 Boyne, P. Et al. Optimal Intensity and duration of walking rehabilitation in patients with chronic stroke. JAMA Neurology. 2023; 1-10



Effects of Exercise

- Improved neuroplasticity
- Improved cognition and behavior
- Improved overall quality of life
- Reduced cardiovascular risk and mortality

7.Nepveu JF et al. A single bout of high intensity interval training improves motor skill retention in individual with stroke. *Neurorehabilitation and Neural repair*.

Effects on Cognition, mood, and stress

- 3 most common reports on effects of exercise on cognitive function, mood and stress
  - Improvements in cognitive tasks that depend primarily on prefrontal cortex ie attention and perception tasks
  - Improvement in mood
  - Decrease in stress

Basso JC & Suzuki W A. The effects of acute exercise on mood, cognition, neurophysiology, and neurochemical pathways: a review. *Brain Plasticity* 2. 2016/2017; 127-152.

Exercise after stroke

- Aerobic exercise is recommended post stroke to improve aerobic condition and walking capacity
  - Recommended moderate physical activity 4-7 days/week for 30-60 minutes supplementing routine activities
  - Intensity at 50-80% maximal heart rate (11-14 on Borg rating of perceived exertion)
- Aerobic exercise has been shown to meaningfully improve VO2 peak and distance walked during the 6 minute walk test

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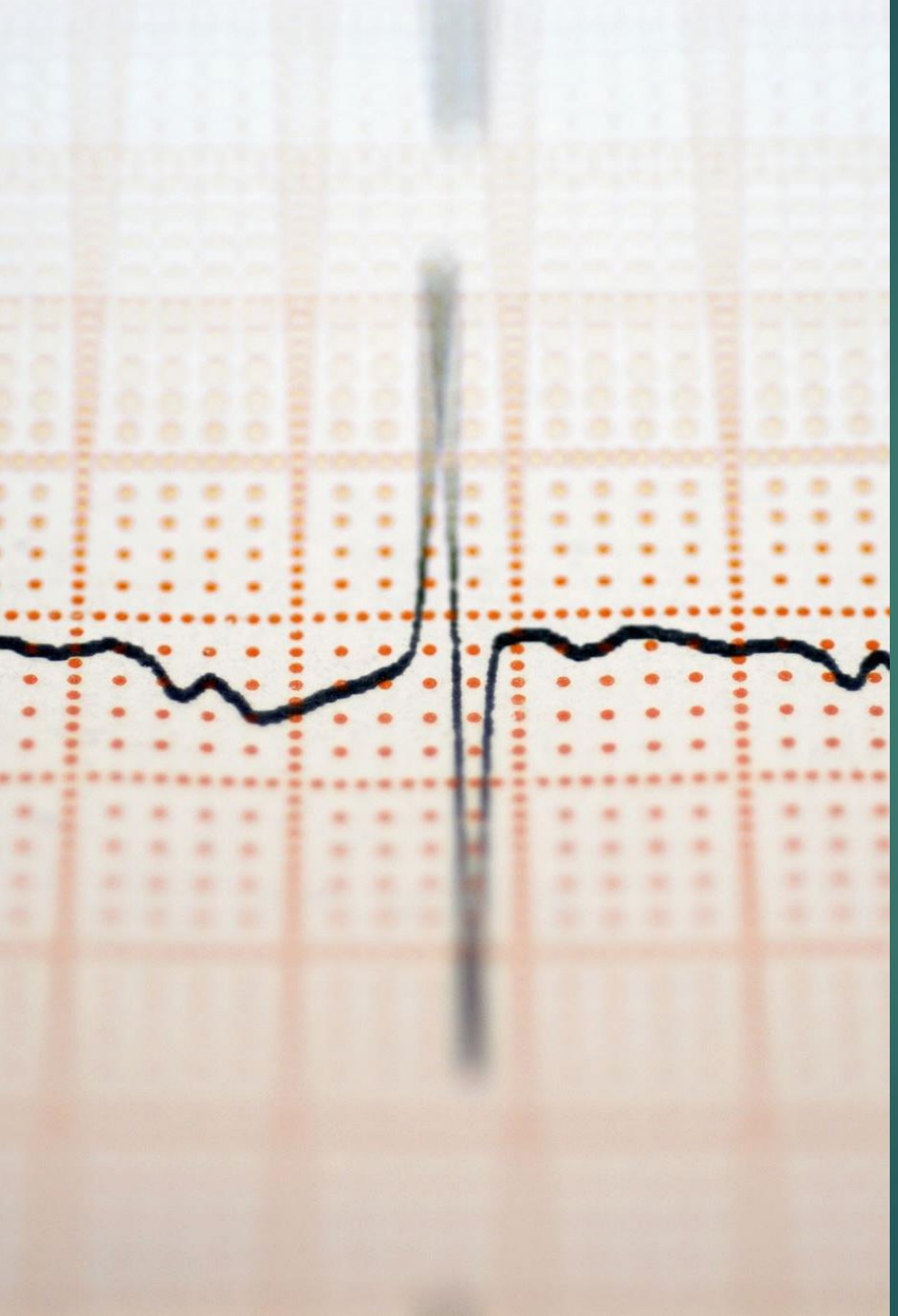

Intensity Parameters

- High intensity: lowest heart rate at least 70% of HR max
- Low intensity: highest heart rate limit no greater than 60% HR max

Pallesen H. et al. The effects of high-intensity aerobic exercise on cognitive performance after stroke: a pilot randomized control trial. Journal of Central Nervous System Disease 2019 (11) 1-10

Exercise effects on neuroplasticity

- Increased lactate
  - Shown to be involved in spatial working memory
- Increased cortisol
  - Shown to influence learning and memory
- Increase in brain derived neurotrophic factor (BDNF)
  - Important for neuroplasticity
- Insulin like growth factor
  - Regulates processes such as muscle hypertrophy, neurogenesis, neuronal survival, differentiation, enhancement of other neurotrophins

Exercise effect on neurotransmitters

- Increase in levels of dopamine, serotonin, norepinephrine, acetylcholine, gamma-aminobutyric acid (GABA) and glutamate
- Dopamine
  - Increase shown with treadmill running
  - Modulates intracortical excitability to enhance plasticity
- Serotonin
  - May have general excitatory effect
- Norepinephrine
  - Increase seen in striatum and frontal cortex after aerobic exercise

Research

- HIIT has been shown to improve:
  - Cognition
  - Fatigue
  - Brain health
  - Gait

2023 Article 1: Boyne P. Et al. Preliminary outcomes of combined treadmill and overground high-intensity interval training in ambulatory chronic stroke. Frontiers in Neurology. 2022 (13); 1-13.

Conclusion

- High intensity exercise is an efficient way to improve mobility, cognition, mood and quality of life through neuroplasticity

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